

# Society for Experimental Mechanics

## Annual Conference and Exposition

3-6 June 2007  
Springfield, Massachusetts

**Abstract title:** Doppler Electron Velocimeter—a Proposed Nano-scale Dynamic Measurement System

**Corresponding author (first name):** Phillip

**Corresponding author (MI):** L.

**Corresponding author (family name):** Reu

**University/Company:** Sandia National Laboratories

**Street address:** PO Box 5800

**Dept/Mail codes:** MS 1310

**City:** Albuquerque

**State:** New Mexico

**Zip/Country postal code:** 87185

**Country:** USA

**Phone:** 505 284 8913

**Fax:** 505 845 8620

**Email:** plreu@sandia.gov

**Presentation type (please indicate either Oral or Poster):** Oral

### ABSTRACT

Phillip L. Reu  
Sandia National Laboratories  
Albuquerque, NM

### Doppler Electron Velocimeter—a Proposed Nano-scale Dynamic Measurement System

As engineering challenges grow in the ever shrinking world of nano-design, methods of making dynamic measurements of these materials and systems will become important. Electron microscopes have imaged these extremely small samples for years, but are incapable of measuring dynamic events. A means of measuring these nano-scale dynamic events is envisioned by converting an electron microscope into a Doppler velocimeter. This idea proceeds from the analogous concept of laser Doppler velocimetry. However, the obvious solution of using a laser to probe at the nano-scale is not feasible because the diffraction limit of light is orders of magnitude larger than the samples of interest. This paper investigates the theoretical underpinnings of using electron beams for Doppler measurements. Potential issues and their solutions, including electron beam coherence and interference will be presented. If answers to these problems can be found, the invention of the Doppler electron velocimeter could yield a completely new measurement concept at atomistic scales.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract No. DE-AC04-94AL85000.

**Keywords:** Nano, MEMS, vibrometry, dynamic measurements, electron microscopy.